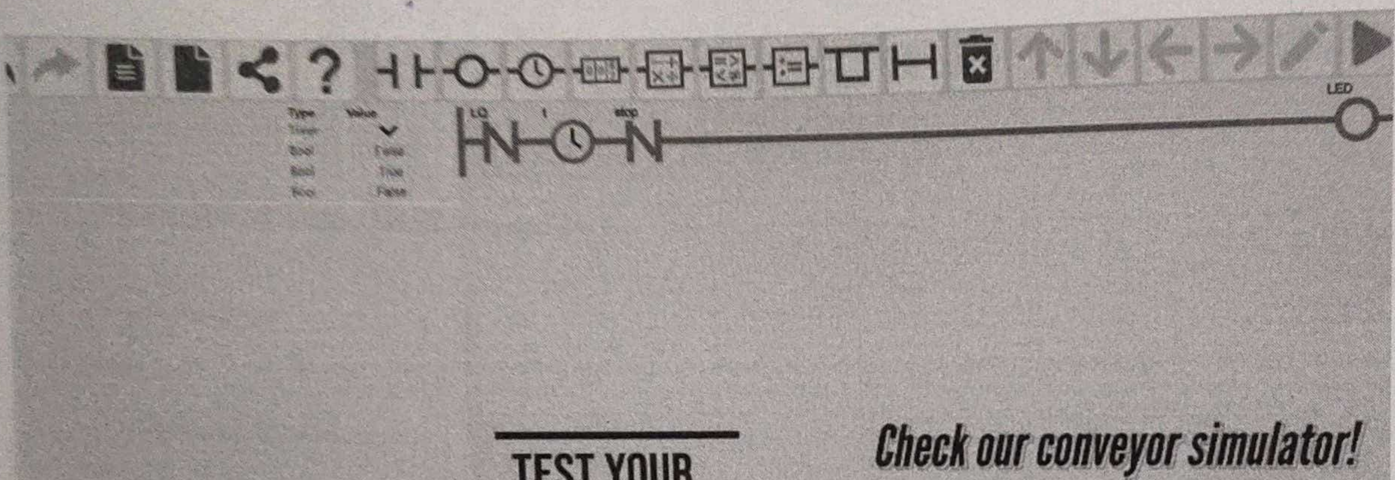
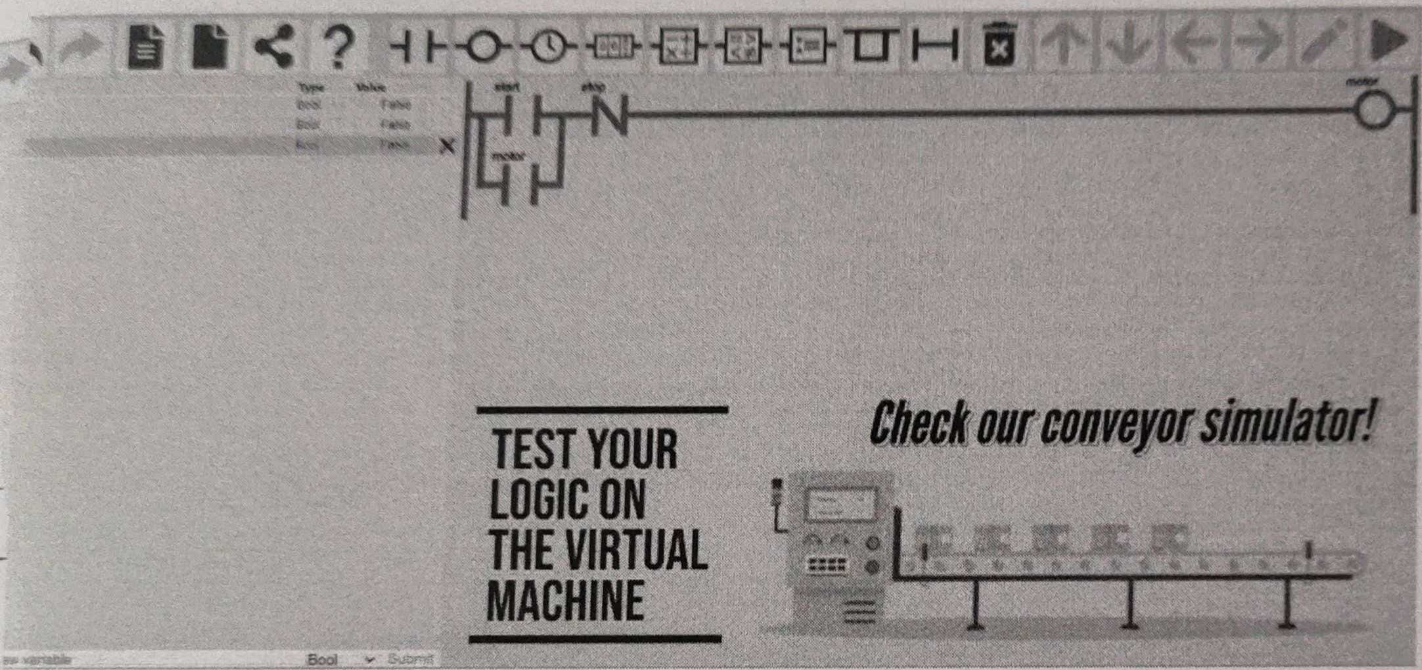

LED
TEST YOUR LOGIC ON THE VIRTUAL MACHINE
Check our conveyor simulator!


TEST YOUR
LOGIC ON
THE VIRTUAL
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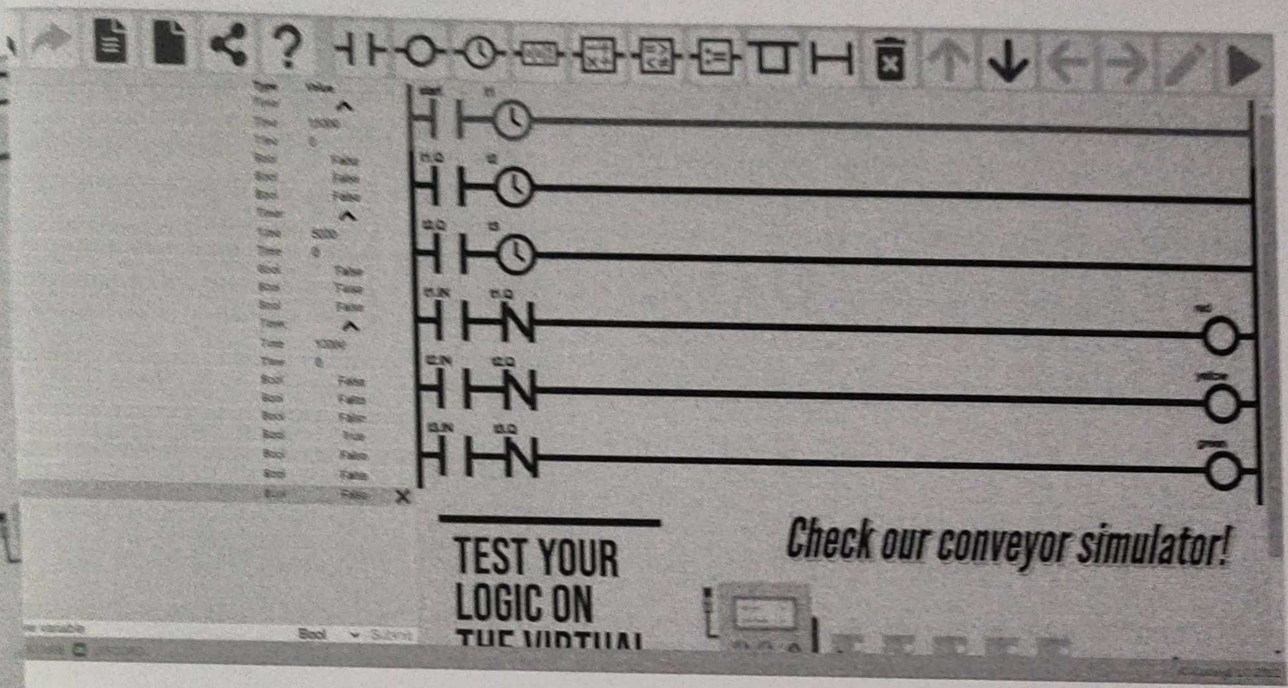
Bool
Submit


TEST YOUR
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Check our conveyor simulator!
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Aim: To control the switching of LED bulb and motion of the brushless DC Motor using Arduino uno.

Apparatus Required: Hardware

Sl. No.	Equipment	Quantity
1	Arduino Uno	01
2	L293D IC	01
3	LED	01
4	DC Motor (Brushless)	01
5	Bread board	01
6	Connecting wire	As per required
7	USB	01

Software: ~~Arduino IDE~~ ARDUINO IDE 2.0.2.

Theory: The Arduino uno is a standard board of Arduino. It was the first USB board released by Arduino. It is considered as powerful board used in various Project.
Arduino UNO is based on an At mega 328P Microcontroller. It is easy to use compared to others boards such as the Arduino Mega boards etc.

The board of Arduino UNO consists of 6 analog pins, 14 digital pins, a USB Connection, a power Jack and an ICSP (In-Circuit serial programming) header. It is programmed based on IDE, which stands for integrated Development environment. It can run on both online and offline Platforms.

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Technical Specifications of Arduino UNO.

(i) These are 20 input/output pins present on it, these 20 pins include 6 PWM pins, 6 analog pins and 8 digital I/O pins.

(ii) The PWM pins are pulse with modulation Capable pins.

(iii) The input voltage of the UNO board varies from 1V to 20V.

(iv) 16MHz frequency of Crystal oscillator.

(v) It has also a Arduino integrated module such Ardunio UNO board is based on the integrated wifi ESP8266 module and AT mega 328D uncontroller

(vi) ARDUINO UNO automatically draws ~~patter~~ power from eternal power from the eternal power supply It can also draw power from the USB.

L293D H-Bridge motor driver ' L293 is defined as the motor driver It that permits the DC motor to drive in any direction It can also simultaneously control two DC motors. It is a 16 pin integrated circuit (IC) It receives signals from the microprocessor present on the Arduino Board and transmits the signal to the motor It has Vcc voltage pins, where one pin draws current for its working and another is used to provide to the DC motor. L293D is one of the most popular motor drivers used to drive the DC motors. It Can run DC motors upto Ampere current load. the four outputs present on L293D driver

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makes it suitable for driving the 4-wire stepper motor as well

procedure:

Connection of motor driver with the DC motor

i) Connect the red terminal of the power supply to the Vcc of L293D

(ii) Connect the black terminal of the power supply to the GND of the L293 D.

(iii) Connect both terminals of the motor to output pin 1 and 2 of L293D driver.

(iv) Connect input pin 2 of L293D to the digital pin 8 of the Arduino Board.

(v) Connect the enable 1 and input 1 to the PWM pin 10 and 11 of the Arduino Board

(vi) Connect Vcc of the L293D driver to the 5V pin of the Arduino Board

(vii) Connect GND of the L293D driver to the GND pin of the Arduino Board

Connection of Ardunio UNO and L2930

Pin 10 and 3 of Arduino UNO is connected with input pin 1 and 2 of L293D.

Connection for LED blinking:

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Simply LED bulb can be connected in series with a resistance or without resistance based on its rating such that positive terminal of LED is connected to any of the digit out pin suppose pin 10 and the other terminal to GND of the board

Observation:
We observed that in case of LED blinking the connected LED bulb glows for 1500ms and gets switched off for the next 1500ms and this process is carried out until the uninterrupted power is provided and connections are closed. In case of DC Motor, we observe that in first it rotates in clockwise for 1500 ms and then stopped for 50ms and then process will run in loop until the step up in not distributed.

Conclusion: In this experiment, we conclude that the using Arduino UNO and Arduino IDE, we can control and efficiently run the LED blinking setup and DC Motor motion switching or we can built up home automation system or other needful works using Arduino UNO with help of other IC's and sensors.

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Aim: To study a second order system with step response

Apparatus Required: DESKTOP, SCILAB 6.1.1

Theory: Given problem: $\frac{Y(S)}{R(S)} = G(S) = \frac{4}{S^2+2S+4}$ → ①

- find the response of the system plot y
- plot Y v/s t
- Find the rise time, peak overshoot, peak time and compare with values from theortical expression

∴ $R(s) = 1/s$, The given system is a second order with input response. To find its response compare with:-

$$T(S) = \frac{W_n^2}{S^2+2\xi W_n} \quad \text{— (II)}$$

by comparing (I) and (II)

$W_n = 2$ and $\xi = 1/2$

so, $y(t) = \frac{1 - e^{\xi W_n t}}{\sqrt{1-\xi^2}} \sin(W_n t + \phi)$

where $W_d = W_n\sqrt{1-\xi^2}$; $\phi = \tan^{-1}\sqrt{\frac{1-\xi^2}{\xi}}$

$W_d = W_n\sqrt{1-\xi^2} = 2 - \sqrt{1-\frac{1}{4}} = \sqrt{3}$

$\tan^{-1}\sqrt{\frac{1-\xi^2}{\xi}} = \tan^{-1}\sqrt{3} = \pi/3$

$$y(t) = \frac{1-2e^{-t}}{\sqrt{3}} \sin(\sqrt{3}t + \pi/3)$$

Rise time:→

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At $(t = t_1 = 0)$, $y(t) = 0$

$$y(t) = 1 - \frac{(e^{-\xi \omega_n t_r})}{\sqrt{1-\xi^2}} \sin(\omega_d t_r + \phi)$$

$$\frac{e^{-\xi \omega_n t_r}}{\sqrt{1-\xi^2}} \sin(\omega_d t_r + \phi) = 0$$

$$\omega_n \sqrt{1-\xi^2}\, t_r = \pi - \tan^{-1} \sqrt{\frac{1-\xi^2}{\xi}}$$

$$t_r = \frac{\pi - \tan^{-1}\sqrt{\frac{1-\xi^2}{\xi}}}{\omega_n \sqrt{1-\xi^2}}$$

$$\frac{\pi - \pi/3}{2\sqrt{1-1/4}} \Rightarrow \frac{2\pi}{3\sqrt{3}}$$

$$t_r = 1.20923$$

Peak time :- $y(t) = 1 - \frac{e^{-\xi \omega_n t}}{\sqrt{1-\xi^2}} \sin(\omega_d t + \phi)$

$$\frac{dy}{dt} = \frac{-e^{\xi \omega_n t} \cos(\omega_d t + \phi)\sqrt{1-\xi^2} + \sin(\omega_d t + \phi)}{\sqrt{1-\xi^2}}$$

$$-\xi \omega_n \frac{e^{-\xi \omega_n t}}{\sqrt{1-\xi^2}}$$

$$\frac{dy}{dt} = \frac{\omega_n e^{-\xi \omega_n t}}{\sqrt{1-\xi^2}} \left[\xi \sin(\omega_d t + \phi) - \frac{\cos(\omega_d t + \phi)}{\sqrt{1-\xi^2}}\right]$$

$$\frac{\omega_n e^{-\xi \omega_n t}}{\sqrt{1-\xi^2}} \left[\sin(\omega_d t + \phi)\cos\phi - \cos(\omega_d t + \phi)\sin\phi\right]$$

$$\frac{\omega_n e^{-\xi \omega_n t}}{\sqrt{1-\xi^2}} \sin(\omega_d t + \phi - \phi) = 0$$

$\Rightarrow \sin(\omega_d t_p) = 0$

$\omega_d t_p = \pi$

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$$tp = \frac{\pi}{\omega d}$$

$$tp = \frac{\pi}{\omega_n\sqrt{1-\xi^2}} = \frac{\pi}{2 - \frac{\sqrt{3}}{2}} = \frac{\pi}{\sqrt{3}} = 1.81388$$

∴ Peak overshoot (Mp)

$$y(t) = y(tp) - \delta(t)$$

$$1 + e^{\frac{-\xi\pi}{\sqrt{1-\xi^2}}} - 1$$

$$Mp = \frac{-\xi\pi}{\sqrt{1-\xi^2}}$$

$$\sqrt{3}/2$$

Observation: we can observe from this experiment that the calculated value differs from the obtained value because we have defined rise time as the time taken for the response to reach its 100% for under ~~depend~~ damped second order system and in Scilab consists only 60% of initial value and hence the difference in obtained value

Rise time: It is the time required to rise from 0 – 100% of its final value, This is applicable for the under damped

Peak time: It is the time required to reach the peak for the first time It is defined tp
This is applicable for the under damped.

peak overshoot: peak overshoot Mp is defined ~~as~~ defined

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as the deviation of the response at peak time from the final value of response.

Conclusion: We can conclude from this experiment that the value of rise and time differs from the calculated value and code value peak time and overshoot value are nearly similar.

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